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Reduction of cavity length dependence and improvement of characteristics of 1.55 μm quantum dot based LASER using indium nitride (Article)

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Abstract

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This paper presents the improvement of certain important characteristics of 1.55 μm laser by reducing the dependence of cavity length using InN based quantum dot in the active layer of the device structure. The improvement of these characteristics has been investigated in terms of ultra low threshold current density, minimization of internal loss, enhancement of the modal gain, external differential efficiency and the photon lifetime. In this paper these characteristics have been investigated using InN based quantum dot in the active layer of the laser structure and compared with GaN and AlN based quantum dot laser. The comparison results reveal that InN based quantum dot provides lower threshold current density, reduced internal loss compared to GaN and AlN quantum dot based laser. Beside these enhanced modal gain, improved efficiency and higher photon lifetime have also been reported using InN based quantum dot in the active layer of the laser structure. In addition to these improvements obtained from the numerical results it is ascertained that InN based quantum dot in the active layer of the laser structure offers weaker dependence of cavity length on these characteristics. From the results it is revealed that InN can be a promising material to design high performance quantum dot based laser operating at 1.55 μm with reduced cavity length dependence in the very near future.

Author keywords

External differential efficiency Internal loss Modal gain Photon lifetime Threshold current density

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